Raytheon

Light Infantry Weapon Fire Control System

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NDIA Guns & Ammunition

9 - 12 April 2001

San Diego, CA

Manportable
Cameras, Sights & Fire Controls

TWS

W1000 Thermal Rifle Sight

ISM

TWS MBS

LRF/DCA

IR Lookout (MAG-2400)

Stinger Night Sight (SNS)

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Leverage:

- Components
- Small Arms Experience
- Common Logistics
- Systems Engineering & Technology

OCSW

Rugged and Lethal !

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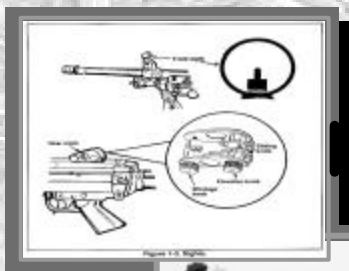
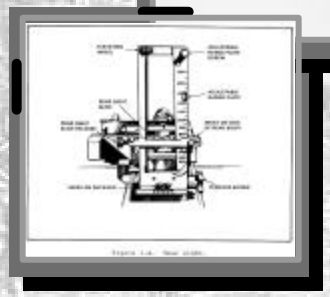
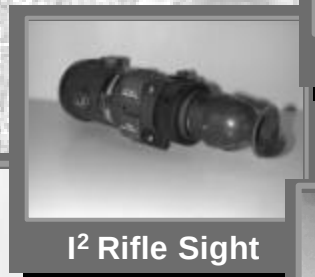
Evolution of the OCSW
Target Acquisition & Fire Control System






I² Rifle Sight


Laser


TWS


TWS/MBS


OCSW TA/FCS

OCSW

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Thermal Weapon Sights

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Heavy & Medium Thermal Weapon Sights

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HTWS

- **Det/Rec of Man: 1650 NFOV**
- **WFOV: 9^{O} az x 3.6^{O} el**
- **NFOV: 3^{O} az x 1.8^{O} el**
- **Mag: W = 3.3X, N = 10X**
- **Weight: 5.38 lbs w/o Battery**

MTWS

- **Det/Rec of Man: 2200 NFOV**
- **WFOV: 18^{O} az x 10.8^{O} el**
- **NFOV: 6^{O} az x 5.4^{O} el**
- **Mag: W = 1.66X, N = 5X**
- **Weight: 4.38 lbs w/o Battery**

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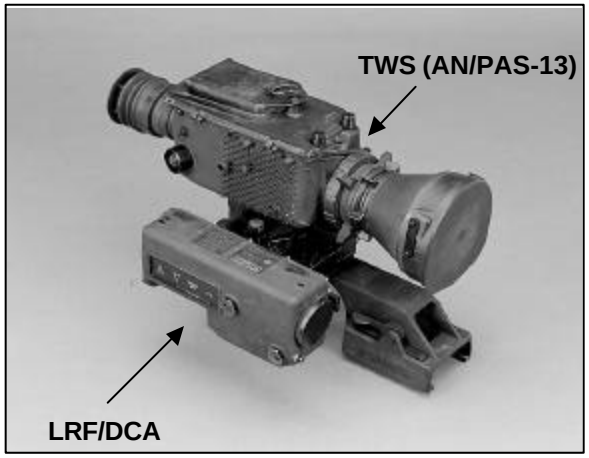
The AN/PAS TWS is subject to the United States Arms Export Control Act (AECA) and the International Traffic in Arms Regulations (ITAR). Export requires license approval from the US State Dept./Office of Defense Trade Controls. Cleared for Public Release August 2000 by SAPA/ and NV-RSTA.

TWS Modular Ballistic Solution (TWS MBS) Raytheon

Specification	TWS	LRF/DCA
Length	40 cm (15.8 in)	21.6 cm (8.5 in)
Width	16 cm (6.3 in)	8.3 cm (3.25 in)
Height	16 cm (6.3 in)	10.16 cm (4.0 in)
Weight w/ battery	2.3 kg (5.0 lb)	0.8 kg (1.8 lb)
Operating Temperature	-37º C to +49º C	-32º C to +49º C
Storage Temperature	-46º C to +71º C	-46º C to +71º C
Time to operation	Less than 120 seconds	Instantaneous
Power Requirements	6 volt BA-5847 or BB-2847	3 volt BA-5123/U or DL123A or commercial equivalent (2 ea)
Mounting	MIL-STD-1913 Rail System	MIL-STD-1913 Rail System
Remote Operation/ Data Transfer	RS-170	RS-232
Mechanical Shock	Withstands primary weapon fire shock (Mk19, M2, and other crew served weapons). Remains aligned after weapons fire.	
Range Output	First or last target ranges are displayed on the TWS within 0.2 seconds after valid return. User selectable. Selected range used for the partial ballistic solution.	
Recognize Man	2.8km	N/A
Detect Vehicle	6.9 km	N/A
Image Polarity	White hot/Black hot	N/A
Detector	40 x 16 scanning FPA, 3-5µm	N/A
Cooling	6-stage thermoelectric cooler	N/A
Detection Range	N/A	99% P(d) at >2500m, 2.3m x 2.3m 10% reflectivity target, 7km visibility
Range Accuracy	N/A	+/- 5 m (3 sigma)
Laser Fire	N/A	<0.10 sec. w/in receipt of command
Substained Fire	N/A	60 pulses/minute continuous
Eyesafety	N/A	Class I per ANSI-Z136-1-1993
False Return Rate	N/A	<1%
Wavelength	N/A	1.533 micron
Beam Divergence	N/A	86% within 0.8mr
Pulse Width	N/A	15-20 ns Full Width Half Maximum



The Thermal Weapon Sight Modular Ballistic Solution (TWS MBS) system combines a fully qualified and fielded Thermal Weapon Sight (AN/PAS-13) cabled to the Manportable Laser Rangfinder/Digital Compass Assembly (LRF/DCA) to provide a disturbed reticle for accurate engagements to the outer effective ranges of the MK19 and M2 platforms (greater than 2km). Both the TWS and LRF/DCA have been tested extensively on the MK19, M2, and other crew served weapons. The TWS MBS can be remotely operated and viewed through a common RS-170 interface port. The interface bracket for both platforms use the standard issue Army brackets with an additional rail grabber for mounting the LRF.

This product is regulated by the United States Arms Export Control Act (AECA) and the International Traffic in Arms Regulations (ITAR) 22 C.F.R. Parts 120-130. Cleared for Public Release January 2001 by SAPA/NV-RSTA.

Light Thermal Weapon Sight (LTWS)

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Weight (lb)		**1.4 kg (3.0 lb) w/ battery**
Detection Range		
Human	**550 m**	
Vehicle	**1650 m**	
Field of View		**15 deg az x 11.3° el**
Operating Temperature	**-37° C to +49° C**	
Maintenance		**Cleaning only**
Video Output		**RS-170/NTSC**
Power Requirements		**Commercial AA Batteries or auxiliary power (via connector for DC sources)**
Mission Operation Life		**5 hrs on commercial AA alkaline or lithium batteries**
Detector		**320 x 240 staring (76,800 pixels) FPA**
Spectral Band		**8-12 µm (longwave infrared)**
Cooling		**Uncooled ferroelectric**
Weapon Compatibility		**M16, M4 - Up to fully automatic 5.56mm CAL**
Mounting		**Picatinny MIL-1913 or NATO/STANAG**

The Light Thermal Weapon Sight (LTWS) is one of the lightest thermal sights available to today's warfighter. The LTWS is based on the combat-proven technology that drives Raytheon's highly fielded line of thermal imaging products. Features of the LTWS are a 2-to-1 electronic zoom, Liquid Crystal Display (LCD), and an eyecup activated stand-by mode for power conservation. The use of the LTWS cannot be detected since it emits no light or RF energy, and it can be used round the clock as ambient light is not required for its operation. Its light weight and compact design make it ideal for use as a hand-held imager and as a rifle mounted sight.

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LRF/DCA Weapon Tests

- No Laser Failures
- LRF/DCA Retained Boresight

Weapon	Caliber	Total
M4 Rifle	5.56mm	21,857
M203 Grenade Launcher	40mm	588
Mk19 Grenade Machine Gun	40mm	1,001
M2 Machine Gun	.50 cal	3,400
M249 Squad Automatic Weapon (SAW)	5.56mm	2,000
M240B Machine Gun	7.62mm	2,000
		30,846

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OCSW Weapon System

- ☑ Weapon/FCS Integration
- ☑ Boresight Retention
- ☑ Weapon Firing Shock Loads

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OCSW ATD TA/FCS

Full Solution Fire Control

- 2.2 km Range Performance
- < ±1 meter Laser Rangefinder
- Ballistic Processor
- Single Reticle
- Fuze Setter
- Digital Compass
- Embedded Training
- MILES/CIDDS
- Thermal Interface
- Direct View Optics 5x9.5° FOV
- Land Warrior Ready
- Laser Steering
- Motion Tracker
- Moving Targets

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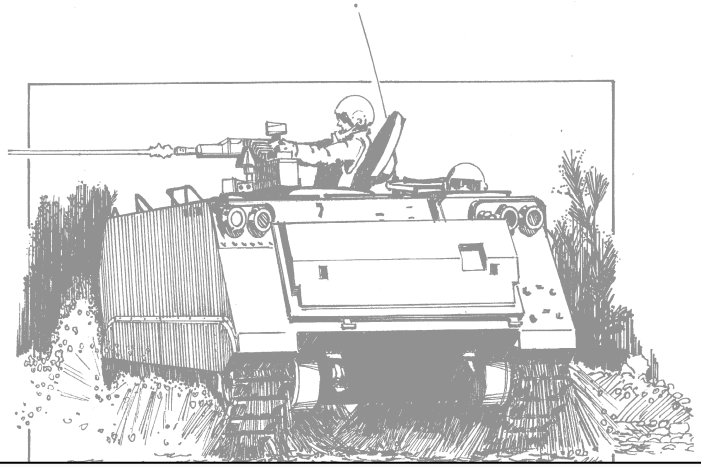
OCSW Target Engagement

Stationary weapon engaging a moving target.

- **Objective: Soldier places reticle on target & fires weapon.**
- **OCSW Approach:**
  - **x & y angular speed is measured via tracker & thermal sensor.**
  - **z speed (range rate) is determined via laser range finder.**
  - **3-D (x,y,z) target vector input to ballistic computation yields ballistically adjusted reticle with lead angle for target motion compensation, any range to intercept for fuze setting.**



The OCSW Full Solution Fire Control Sensor Suite is ideally suited to effectively engage lightly armored moving targets.

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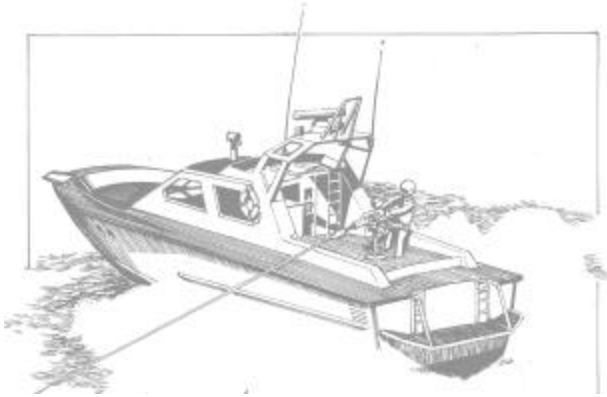
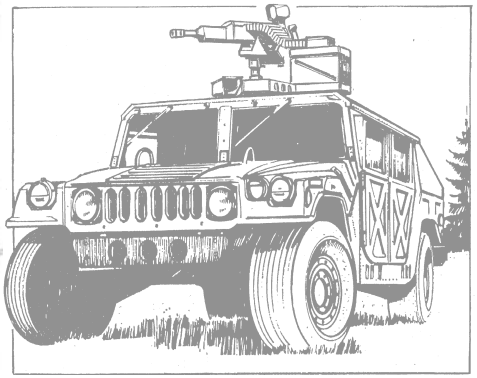
OCSW Target Engagement

Moving weapon engaging a moving target.

- **Objective: Engage moving targets from a moving vehicle.**
- **OCSW Approach:**
  - **Tracker, Laser & Thermal sensors determine relative 3-D target vector.**
  - **Ballistic computation yields aim point compensated for relative motion.**
  - **Weapon is aimed via 2-axis stabilized gimbaled platform.**
  - **Weapon is remotely fired by crew.**





The OCSW has Potential for Multiple Platform Applications as Primary/Secondary Armament.

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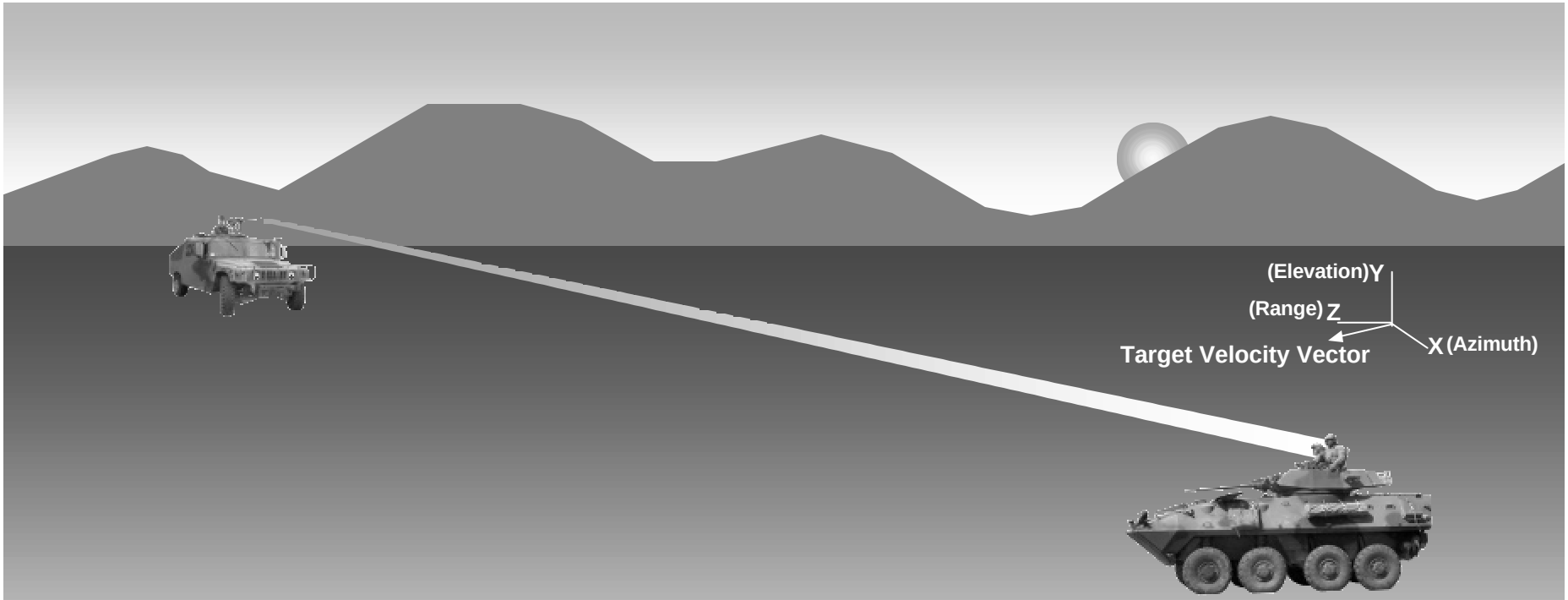
OCSW Target Engagement



Elevation Lead (mils) = Target Elevation Rate (mil/sec) x Time of Flight (sec)

Azimuth Lead (mils) = Target Azimuth Rate x Time of Flight [f(Ammo, Range to Intercept)]

Fuze Setting (m) = Range to Intercept = Target Range (m) - [Range Rate (m/sec) x Time of Flight (sec)]

Raytheon's OCSW Approach

- **Maximize Component Commonality with Other Products (laser, thermal, compass, camera, electronics, etc…)**
  - **Common module architecture**
  - **Minimize development cost**
  - **Minimize O&S cost**
  - **Reduce TA/FCS unit cost via larger production quantities**
- **Leverage Raytheon's Many Diverse Technologies and Programs**
  - **Increased performance at less cost, weight and risk**
- **All Solid State Design**
  - **Leap-ahead in reliability and maintainability**
  - **Low power and weight**

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Weight/Power: Determined by Core Technologies/Components

- 25 Micron Uncooled Thermal Detector
  - 8x reduction in volume compared with 50 Micron for constant F/# and IFOV
- Ability to Integrate Electronics
- Laser
  - Diffraction limited beam minimizes optics weight/cost
  - Single pump diode and passive Q-switch
  - Very efficient low cost/weight cavity
- Low Cost/High Sensitivity Laser Detector
  - Minimizes required transmitted energy
  - Ruggedized low cost production detector hybrid
- Solid State Laser Steering
  - Very low cost: No mechanical moving parts
- Advanced Materials/Composites

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Smaller Pixel Yields
Dramatic System Improvements

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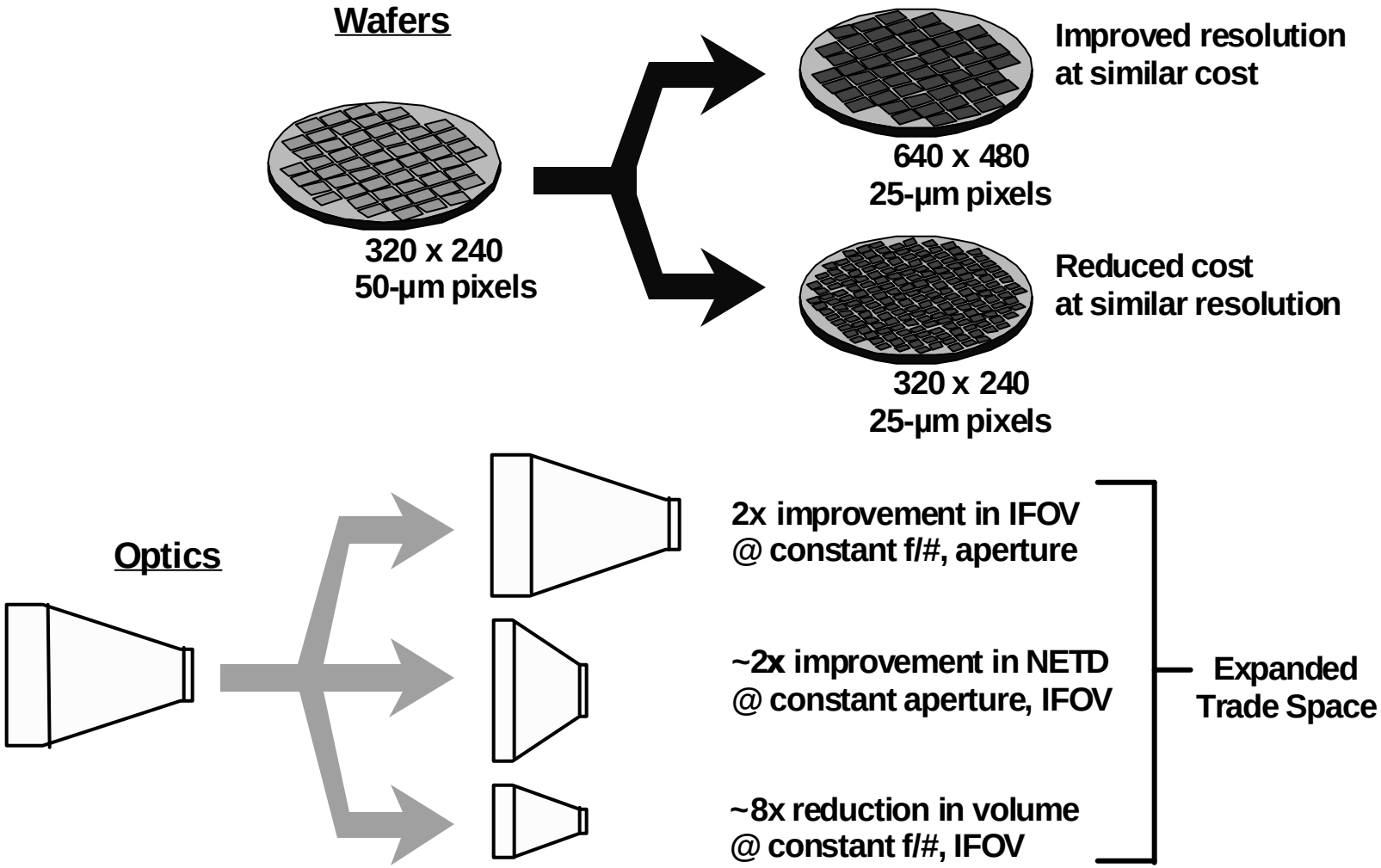

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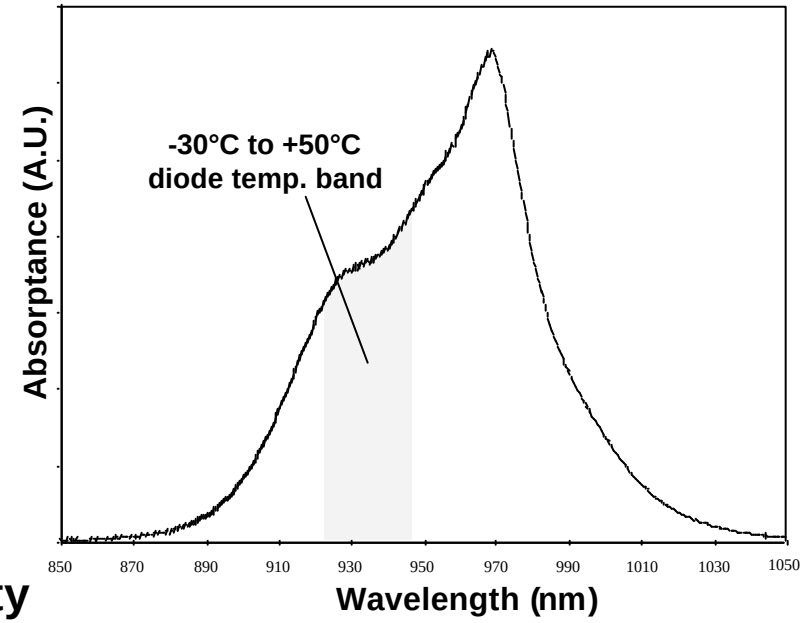
Advantages of Er:Glass Lasers

Passive - Cooling Diffraction Limited Beam - 100% Solid State

- ❑ Key advantages of diode-pumped Er:Yb:glass:
  - ✓ Direct eyesafe wavelength
    - – no wavelength conversion
    - – fewer components
    - – diffraction limited beam quality
  - ✓ Broad Yb absorption
    - – insensitive to diode wavelength shifts over temperature
    - – passive cooling



- ❑ Enabling technologies:
  - ✓ Passive Q-switch
  - ✓ High efficiency diode pump cavity
  - ✓ Long Er lifetime (> 30x that of Nd:YAG)
    - – more pump energy per diode bar

Leap-Ahead Cost Advantage

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Manportable
Cameras, Sights & Fire Controls
for Small Arms Weapon Systems

Infantry Deserves the Very Best !

- ***Low Weight, Power & Cost***
- ***Ruggedized - 100% Solid State***
- ***Full Solution Fire Control Systems***

Uncooled Thermal Sensor
Laser Range Finder
Direct View Optics
CIDDS/MILES
Digital Compass
Ballistic Processor
Fuze Setter

- ***Life Cycle Cost***
  Embedded Training
  Logistics (ILS)

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